

Considered
at the meeting of the Academic
Council of the University
Minutes No. ____
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APPROVED
Chairman of the Board
"S. Seifullin Kazakh Agrotechnical
University" JSC

A.K. Kurishbayev
" ____ " ____ 2019

EDUCATIONAL PROGRAM
"Electrical networks"

Code and classification of the field of education	7M07 Engineering, manufacturing and construction industries
Code and classification of areas of training	7M071 Engineering and Engineering
International Standard Classification of Education Code	071
Qualification	Master of Engineering Science in the educational program "Electrical Networks"
Training period	2 years / 1.5 years

Nur-Sultan, 2019

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Educational program " Electrical networks "
Considered at a meeting of the department "Power supply"
Minutes No. 13 of 04/18/2019

Head of the Department of "Power supply" G.G. Tatkeeva

approved by the Faculty Council
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Dean of the Faculty of Energy S.S. Isenov

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1 Passport of the educational program

1.1 The purpose of the educational program:

The educational program "Electric Networks" was created on the basis of an analysis of the current state of the industry, taking into account the requirements of the labor market, trends in the development of the electric power industry and the request of employers.

Main aim of programs is a preparation of highly qualified specialists engaged in the production and distribution of electricity, with in-depth scientific and pedagogical training, capable of formulating and solving modern scientific and practical problems in science and production in the field of electric power.

The main objectives of the educational program:

- providing a theoretical and practical knowledge base for mastering professional competencies;
- the ability to apply the knowledge gained to solve problems related to the production and distribution of electricity;
- obtaining undergraduates of practical skills in solving specific professional problems in the design and operation of electrical networks;
- familiarization with the real processes of production, research and development and design activities in the profile of "Electric Networks".

2 General characteristics of the educational program (relevance, features, competitive advantages, uniqueness, stakeholders, etc.)

The educational program "Electric Networks" was developed in accordance with the National Qualifications Framework and Professional Standards, coordinated with the Dublin descriptors and the European Qualifications Framework.

The relevance of the EP "Electric Networks" is confirmed by the active participation of employers in the development of the educational program. The success of the implementation of the educational program is determined by the systematic, purposeful and effective implementation of the goals and development plan of the cluster developed with the involvement of all interested parties of the program, taking into account the analysis of the satisfaction of students and employees, the analysis of the resources available and necessary for the program, including the material and technical base.

A special feature of the "Electrical networks" profile is the training of graduates who have an idea of: the design and operation of electrical networks, power supply systems, the use of modern electrical equipment and materials in them; about

the appointment of electromechanical complexes as a part of machinery and equipment, about the structure and technical characteristics.

3 Competence model (portrait) of a graduate

3.1 The areas of professional activity

The sphere of professional activity is the field of science and technology, which includes a set of technical means, methods and methods of human activity for the production, transmission, distribution, transformation, use of electrical energy, energy flow control, development and manufacture of elements, devices and systems that implement these processes.

3.2 Professional activities

Master in EP "Electric Networks" prepares for the following main types of professional activities: production and technology; design and technological; organizational and managerial.

Additional types of professional activities are: research and service and operational.

The subjects of professional activity of the Master in the educational program "Electrical Networks" are: distribution electrical networks; power stations and substations; relay protection and automation of distribution networks.

3.3 General educational competencies

Based on the results of mastering the educational program "Electric Networks", a graduate of the master's program must have the following competencies:

General cultural competencies:

- the ability to generalize, analyze, perceive information, set a goal and choose ways to achieve it;
- the ability for written and oral communication in the state language: the ability to logically correctly, reasonably and clearly build oral and written speech; readiness to use one of the foreign languages;
- willingness to cooperate with colleagues, work in a team;
- the ability to find organizational and managerial solutions in non-standard conditions and in conditions of different opinions and the willingness to take responsibility for them;
- the ability and willingness to comply with the rights and obligations of a citizen; to free and responsible behavior.

3.4 Core competencies

General professional competencies:

- the ability and willingness to use information technology, including modern computer graphics in their subject area;
- the ability to demonstrate basic knowledge in the field of natural sciences and the readiness to use the basic laws in professional activity, to apply the methods of mathematical analysis and modeling, theoretical and experimental research;
- the readiness to reveal the natural-scientific essence of the problems arising in the course of professional activity, and the ability to attract the appropriate physical and mathematical apparatus for their solution;
- the ability and willingness to use regulatory legal documents in their professional activities;
- possession of the basic methods of protecting production personnel and the population from the consequences of possible accidents, catastrophes, natural disasters;
- the ability and willingness to analyze scientific and technical information, to study domestic and foreign experience on the research topic;
- the ability to form a complete idea of the decisions made and the results obtained in the form of a report with its publication.

3.5 Professional competencies

Profiled specialized competencies:

- ability to count technical and economic indicators of electrical networks;
- the ability to draw up equivalent circuits of elements;
- the ability to calculate short-circuit currents in electrical networks;
- ability to count electrical load consumers electricity and their integral characteristics;
- the ability to calculate indicators of the quality of electricity at electrical consumers;
- ability to count level and indicator's reliability power supply to consumers;
- the ability to assess the undersupply of electricity.
- the ability to draw up equivalent circuits for electric power systems and networks;
- ability to use of methods analysis modes work electric power and electrical equipment and systems;
- ability to holding standard trials electric power and electrical equipment and systems.

4 The base of passing professional practices

In order to consolidate the theoretical knowledge obtained by undergraduates at the university and acquire practical skills in working on EP

“Electrical networks, the undergraduate must master the following types of professional practice:

1 Teaching practice.

The goal of pedagogical practice is to consolidate and deepen knowledge in psychological, pedagogical, methodological and profiling disciplines, as well as to form pedagogical skills, skills and competencies on the basis of theoretical knowledge. Pedagogical practice is aimed at combining general scientific, didactic, methodological, subject and psychological and pedagogical training.

Practice objectives: the program of pedagogical practice is aimed at the implementation of theoretical knowledge and improvement of practical skills and abilities of working with a student group.

In the course of passing pedagogical practice, it is necessary: to get acquainted with the tasks, content and features of educational, methodological and educational work at S. Seifullin KATU; to study the real state of the integral pedagogical process of the university; study the age characteristics of bachelor students; curricula, work programs in the subject of their specialty and other educational and methodological documentation of the department; practically master all forms of organization of education at the university, draw up lecture notes, plans for seminars, practical and laboratory classes.

2 Research practice.

The purpose of the research practice is to master the basic techniques of conducting research work and the formation of a professional worldview in this area, in accordance with the profile

"Electricity of the net".

Practice objectives

This type of practice solves the following tasks:

1) to form a comprehensive understanding of the specifics of the activities of a scientist in the direction of "Electrical networks";

2) master methods research, in the greatest degree corresponding to the profile in the direction of "Electrical networks";

3) improve skills and skills independent research activities;

4) improve personality the future scientific employee, specializing in the electric power industry.

Postgraduates on the educational program "Electric networks" are in demand on the market electric power infrastructure and the needs of society.

A graduate of this educational program can prove themselves, as:

- Highly qualified specialist in the operation of electrical networks, power plants and substations.
- Highly qualified specialist in the design of electrical networks, power plants and substations.
- Highly qualified specialist in organizations designing cable lines, power transformers, high-voltage switching devices.
- Organization of our own private production and installation of electrical networks, high-voltage and low-voltage equipment, consulting and commercial activities in this area.

Undergraduates undergo training at large enterprises in the electric power industry in the Republic of Kazakhstan: KEGOC JSC, Samruk Energo JSC, AEDK JSC, Astana-REC JSC, Kokshetauenergo LLP, Karagandy Zharyk LLP, Tavrida Electric Astana LLP, Astanaenergосervice LLP, Kazelektromontazh LLP, Ekibastuz State District Power Plant LLP, MAEK-Kazatomprom LLP, Kazakhenergoexpertiza JSC and others.

5 The structure of the educational program of the magistracy in the scientific and pedagogical direction

P / p No	The name of the cycles of disciplines and types of activities	Total labor intensity	
		in academic hours	in academic credits
1	2	3	4
1.1	Cycle of basic disciplines (DB)	1080	36
1)	University component (VK):	630	21
	including:		
	History and philosophy of science	150	five
	Foreign language (professional)	150	five
	Higher education pedagogy	90	3
	Psychology of management	150	five
	Teaching practice	90	3
2)	Optional component (CV)	450	fifteen
	Alternative and renewable energy sources	90	3
	Reliability of electrical networks	150	five
	Energy efficiency of electricity conversion	90	3
	Electrotechnical complexes and systems	120	four
1.2	The cycle of profiling disciplines (PD)	1590	53
1)	University component (VK)	930	31
	Theory and practice of technical experiment in the electric power industry	150	five
	Special issues of relay protection and automation	180	6
	Special issues of power supply	150	five
	Mathematical modeling in the electric power industry	180	6
	Scientific and technical problems of the electric power industry	150	five
	Stability of electrical power systems	120	four
2)	Optional component (CV)	660	22
	Optimization of power supply systems of the agro-industrial complex	150	five
	Optimization of power supply systems for industrial enterprises	150	five
	Research practice	360	12
2	Research work	720	24
1)	Research work of a master student, including an internship and a master's thesis (NIRM)	720	24
3	Additional types of education (FEB)		
4	Final certification (IA)	360	12
1)	Registration and defense of a master's thesis (OiZMD)	360	12
	Total	3750	125

The structure of the master's educational program in the profile direction

P / p No .	The name of the cycles of disciplines and types of activities	Total labor intensity	
		with a training period of 1.5 years	
		in academic hours	in academic credits
1.1	Cycle of basic disciplines (DB)	420	14
1)	University component (VK)	180	6
	including:		
	Foreign language (professional)	60	2
	Management	60	2
	Psychology of management	60	2
2)	Optional component (CV)	240	8
1.2	The cycle of profiling disciplines (PD)	1350	45
1)	University component (VK)	1050	35
2)	Optional component (CV)	300	10
3)	Internship	180	6
2	Experimental researchWork	540	18
1)	Experimental research work of a master student, including an internship and the implementation of a master's project (EIRM)	540	18
3	Additional types of education (FEB)		
4	Final certification (IA)	360	12
1)	Registration and defense of a master's project (OiZMP)	360	12
	Total	2850	95

Appendix 3 Description of disciplines of the DB cycle

1. Basic information about the discipline: 385073010

Basic information about the discipline:	
1. Description of the discipline	History and philosophy of science
2. Number of credits	5 (scientific and pedagogical)
3. Prerequisites:	Philosophy. Political Science and Sociology.
4. Post-requisites:	Knowledge of the history and philosophy of science will contribute to the formation of scientific knowledge at the specialization and methodology of scientific knowledge, skills and abilities of research activities.
5. Competencies:	Know and understand: basic epistemological models, the nature of transformations of the concept of rationality; forms and methods of pre-scientific, scientific and extra-scientific knowledge, modern methods of knowledge. Be able to: formulate and solve problems arising in the course of research work and requiring in-depth professional knowledge; choose the necessary research methods, modify existing and develop new methods based on the tasks of a particular research. Own methodological and methodological knowledge in scientific research and pedagogical work. Have the skills of conducting independent research and scientific-pedagogical activities, requiring broad education in the relevant direction; writing scientific theses, articles; speeches at scientific forums. Be able to analyze and comprehend realities modern theory and practice based on the methodology of socio-humanitarian and natural science knowledge.
6. Course author	Department of Philosophy
7. Main literature	<p>1. History and philosophy of science. Under. ed. Kryaneva Yu.V., Motorinsky L.E., - M; INFA-M, 2011. -- 416 p.</p> <p>2. Myrzaly S.K. Ylymnyǵ tarikhy men of philosophy. - Almaty: Bastau, 2014.</p> <p>3. Stepin V.S. History and philosophy science. -M: Academic project, 2011. -423 p.</p> <p>4. Khasanov M. Sh., Petorova V.F. History and philosophy of sciences. -Almaty: Kazakh University, 2013, -150 p.</p>
8. Content of the discipline	The study of the discipline "History and Philosophy of Science" is to familiarize undergraduates with the structure of scientific knowledge, with the methods of scientific research, with the functions of scientific theories and laws; expanding their world outlook; developing ideas about the criteria for scientific character and the requirements that scientific research and its results must meet, as well as development of a style of scientific thinking based on the study of the history and philosophy of science.

Basic information about the discipline:	
1. Description of the disciplines	Foreign language (professional)
2. Number of credits	five
3. Prerequisites:	Foreign language (bachelor's degree). English for Specific Purposes. Professionally oriented foreign language.
4. Post-requisites:	Disciplines by specialties on the English language. Academic writing.
5. Competencies:	<p>Know the functional and stylistic characteristic scientific presentation of material in the studied foreign language, general scientific terminology and terminological sublanguage of the relevant specialty in a foreign language, the basics of business correspondence in the framework of international cooperation.</p> <p>Be able to freely read, translate the original literature in the chosen specialty with subsequent analysis, interpretation and evaluation of the extracted information, explicate scientific information in writing (abstract, abstract, summary), participate in professional discussion, scientific debate;</p> <p>Have the skills to make a presentation of scientific research (at seminars, conferences, symposia, forums), listen and understand public speaking in direct and indirect communication (lectures, reports, television and Internet programs);</p>
6. Course author	Department of Foreign Languages
7. Main literature	<p>1 Belousova A.R., Melchina O.P. English for Agricultural Students, 2010.</p> <p>2. Principles of Management, By: Mason Carpenter, Talya Bauer, Berrin Erdogan and Jeremy Short, Version: 2.0 Pub Date: March 2013</p> <p>3. Team of Teams: New Rules of Engagement for a Complex World Hardcover - May 12, 2015</p>
8. Content of the discipline. What is agriculture? Knowledge of the subject. Tools and equipment. Functions. What should you read? Bank of authentic materials. Work skills. Identification of the culture of the place of work. Identification of target events. Organizational structure. Job descriptions. Job interview. To-do lists. Organization of fairs and conferences. Job change.	

Basic information about the discipline:	
1. Description of the discipline	Higher education pedagogy
2. Number of credits	3 (scientific-ped.)
3. Prerequisites:	Philosophy. Political science and sociology. Culturology and psychology.
4. Post-requisites:	Pedagogical practice. Implementation activities teacher of higher professional education and management of the pedagogical process.
5. Competencies:	<p>As a result of studying the discipline "Pedagogy of Higher Education" master student</p> <ul style="list-style-type: none"> - will learn: topical problems of pedagogical science; the essence of the pedagogical activity of a university teacher; - will master the skills: selection of pedagogical facts, phenomena, events from the surrounding reality and their description in the language of pedagogical science, relying on the laws of pedagogical theories, explanation, forecasting and development; designing the educational process, based on new concepts of teaching and upbringing. <p>Will be competent: in teaching and in solving problems of higher pedagogical education and the prospects for its further development; in the application of effective teaching technologies in higher educational institutions; solutions to urgent psychological and pedagogical problems, assessment of the results achieved;</p>
6. Course author	Department of professional learning (Sagalieva J.K., Zhusupova A.A., Shakhmetova D.S., Seilkhan G.I.)
7. Main literature	<ol style="list-style-type: none"> 1. Zavada G. V., Bushmina O. V. Pedagogy of higher education: Textbook. allowance. - Kazan: KSPEU, 2008. 2. Kuznetsov AND. N. Tabletop book practitioner teacher: Textbook. allowance. - M.: GrossMedia: ROSBUKH, 2008. 3. Esekeshova M. D., Sagalieva Zh.K. Higher school pedagogy: Textbook. allowance. - Astana: Foliant publishing house, 2018.
8. Content of the discipline	Fundamentals of higher education pedagogy. The subject and tasks of higher education pedagogy. Methodology and methods of pedagogical research in higher education. Higher school didactics. Pedagogical process in higher education. Laws, patterns and principles of teaching. Methods, forms and means of teaching in higher education. The current state of higher education in the Republic of Kazakhstan. Professional development of a higher school teacher. The process of education in higher education. The purpose of education as a pedagogical problem. Educational and educational team as a form of functioning of an integral pedagogical process. Management of the pedagogical process.

Basic information about the discipline:	
1. Description of the discipline	Psychology of management
2. Number of credits	5 (scientific-ped.), 2 (prof.)
3. Prerequisites:	Philosophy. Political science and sociology. Culturology and psychology.
4. Post-requisites:	Teaching practice. Research practice. Psychological escorts management activities; methods of working with functional states in activities manager. Methodological foundations of scientific research.
5. Competencies:	<p>As a result of mastering the discipline, the master student must: Know:</p> <ol style="list-style-type: none"> socio-psychological content and structure of management activities; and management functions; psychological characteristics of the leader's personality; psychological patterns of joint activities achieving organizational goals; basic approaches to solving managerial problems and the rules for their solution in the conditions of actually operating production structures, methods work with functional states in the activities of a manager, optimization of management processes; <p>Be able to:</p> <ol style="list-style-type: none"> apply the knowledge gained during the course; freely operate with psychological concepts; use psychological knowledge when explaining phenomena in the field of management psychology and group processes. analyze the professional activity of a manager from the point of view of ensuring his psychological effectiveness; apply methods, techniques aimed at developing the professionalism of management personnel, the personality of the manager. <p>Own:</p> <ol style="list-style-type: none"> professional skills of psychological analysis of the professional activity of a manager, phenomena in the world of work and joint activities to achieve organizational goals; practical skills psychological escorts managerial activities; methods work with functional states in the activities of the manager; skills use of developing technologies aimed at improving the professionalism of management personnel and team leadership; <p>Be competent in the readiness to lead a team in the field of their professional activities, tolerantly perceiving social, ethical, confessional and cultural differences.</p>
6. Course author	Zhusupova A.A., Sagalieva Zh.K., Shakhmetova D.S., Seilkhan G.I.
7. Main literature	1. Stolyarenko A.D. "Psychology of Management" Rostov - on -

	<p>Don Phoenix 2007.</p> <p>2. Stolyarenko HELL. "Psychology business communication and management "Rostov - on - Don" Phoenix "2008.</p> <p>3. Volkogonova O.D., Zub A.T. "Management Psychology" Moscow Publishing House "Forum" - Infra - M 2007.</p>
8. Content of the discipline	<p>Fundamentals of Psychology. Psychological aspects of small groups and collectives. "Socio-psychological basics activities of the head ".</p>

Basic information about the discipline:	
1. Description of the discipline	Teaching practice
2. Number of credits	2
3. Prerequisites:	
4. Post-requisites:	

<p>5. Competencies:</p>	<p>Have an idea of</p> <ul style="list-style-type: none"> - forms organization educational and scientific activities at the university; - modern educational information technologies; - the content and structure of classes taking into account the modern requirements of didactics (scientific nature); <p>Know and understand:</p> <ul style="list-style-type: none"> - State educational standard and educational program; - educational and methodological literature, laboratory and software for the recommended disciplines of the curriculum; - foundations of philosophy and methodology of science <p>Be able to:</p> <ul style="list-style-type: none"> - prepare and conduct training sessions on the instructions of the head of the practice, visit and analyze the classes of experienced teachers and their colleagues; - formulate and solve their problems arising in the course of pedagogical activity. - analyze and assess the levels of their competencies in combination with the ability and willingness to self-regulate further education and professional mobility; - analyze professional information, highlight the main thing in it, structure, formalize and present in the form of analytical reviews with substantiated conclusions and recommendations; <p>Own:</p> <ul style="list-style-type: none"> - a culture of thinking, the ability to build a logic of reasoning and statements based on the interpretation of data, integrated from different fields of science and technology, to make judgments based on incomplete data - methodology for preparing and conducting various forms of conducting classes; - methodology for analyzing training sessions; <p>Acquire practical skills:</p> <ul style="list-style-type: none"> - conducting practical and laboratory classes with students on the recommended topics of academic disciplines;
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	- conducting trial lectures in student audiences under the supervision of a teacher on topics related to scientific research work of the undergraduate.
6. Course author	Department of Power Supply
7. Main literature	<p>List of main literature</p> <p>1 Model rules for the activities of organizations of higher and postgraduate education. Approved by the Resolution of the Government of the Republic of Kazakhstan dated May 17, 2013 No. 499.</p> <p>2 State compulsory standard of postgraduate education. Approved by the Resolution of the Government of the Republic of Kazakhstan dated August 23, 2012 No. 1080. Rules for organizing the educational process on credit technology of education Approved by order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152.</p> <p>1. Smirnov S.D. Pedagogy and psychology of higher education: Textbook: from activity to personality / S.D. Smirnov. - M.: Aspect Press, 2011 .-- 271 p.</p> <p>2. Smirnov S.D. Pedagogy and psychology of higher education: from activity to personality [Text]: textbook for universities / S.D. Smirnov. - M.: Academy, 2003 .-- 304 p.</p> <p>3. Yakunin V.A. Educational psychology: textbook / V.A. Yakunin. - 2nd ed .. - St. Petersburg. : Publishing house of Mikhailov V.A., 2000. - 349 p.</p> <p>4. Pedagogy: textbook for universities / ed. P.I. Pidkasiyogo. - M.: Ped. Society in Russia, 2014 .-- 608 p.</p> <p>5. Practical psychology: textbook / ed. M.K. Tutushkina. - M.: ASV; SPb. : Didactics Plus, 1997 .-- 336 p.</p>
8. Content of the discipline.	Acquaintance with the structure of the educational process in a higher educational institution and the rules for maintaining the reporting documentation by the teacher; familiarization with the program and content of the courses taught; familiarization with the organization and conduct of all forms of training sessions; independent preparation of plans and abstracts of classes in academic disciplines; study and application of innovative teaching methods in the educational process; selection and analysis of basic and additional literature in accordance with the topics and objectives of the classes; development of the content of educational material at the modern scientific and methodological level; methodologically correct conduct of various types of training sessions (lectures, practical, seminars and laboratory exercises); implementation of scientific and methodological analysis of the conducted classes.

Basic information about the discipline:	
1. Description of the discipline	Non-traditional and renewable energy sources
2. Number of credits	4 (3)
3. Prerequisites:	Power supply, Electrical networks and systems, Electric power stations and substations
4. Post-requirements:	Theory and practice of technical experiment in the electric power industry
5. Competencies:	<p>To know: information, mathematical and methodological support for the calculation of different categories of the potential of hydro and wind resources; domestic and foreign experience in the field of hydropower and wind energy, as well as the prospects for their development; purpose, classification, design and physical basis of the main power equipment of hydropower and wind power plants (HPP, SHPP, PSPP, WPP); the main energy, environmental and economic characteristics of different types of hydropower and wind power plants (HPP, SHPP, PSPP, WPP); the main technical schemes for the use of hydro and wind energy for the power supply of centralized and decentralized consumers; features and methods for calculating the operating modes of hydropower and wind power plants (HPP, SHPP, PSPP, WPP) for the power supply of centralized and decentralized consumers; features of the choice of parameters and composition of the main power equipment of hydropower and wind power plants (HPP, SHPP, PSPP, WPP) for the power supply of centralized and decentralized consumers.</p> <p>To be able to: use modern domestic and foreign information support for hydro and wind resources; perform calculations to determine the main categories of the potentials of hydro and wind resources, taking into account social and environmental factors; use modern domestic and foreign software for the selection of parameters of hydropower and wind power plants (HPP, MHPP, PSPP, wind turbine) for power supply to centralized and decentralized consumers; search, analysis and selection of scientific and technical information.</p>
6. Course author	Department of Electrical Equipment Operation
7. Content of the discipline.	<p>Informational, mathematical and methodological support for the calculation of different categories of potential of hydro and wind resources; domestic and foreign experience in the field of hydropower and wind energy, as well as prospects for their development; purpose, classification, design and physical basis of the main power equipment of hydropower and wind power plants; main energy, environmental and economic characteristics of different types of hydropower and wind power plants; the main technical schemes for the use of hydro and wind energy for the power supply of centralized and decentralized consumers; features and methods for calculating the operating modes of hydropower and wind power plants for the power supply of centralized and decentralized consumers; features of the choice of parameters and composition of the main power equipment of hydropower and wind power plants for the power supply of centralized and decentralized consumers.</p>

Basic information about the discipline:	
1. Name of the discipline	Energy efficiency of electricity conversion
2. Number of credits	6
3. Prerequisites:	Power supply, Electrical networks and systems, Power stations and substations, Relay protection and automation of power supply systems
4. Post-requirements:	Optimization of power supply systems for rural, industrial and energy enterprises
5. Competencies:	<p>Demonstrate knowledge and understanding in the field of study, formed on the basis of general secondary education, and include certain aspects related to the most advanced knowledge in the field of study.</p> <p>Know: basic electrical and switching equipment of power plants and substations; diagrams of electric power systems and networks, constructive implementation of overhead and cable power transmission lines; fundamentals of power supply systems for industrial enterprises and transport systems; principles of construction of relay protection and automation of electric power systems; physical processes of electrical breakdown in various environments, principles of implementation and testing of high voltage insulation</p> <p>Know: information, mathematical and methodological support for the calculation of energy efficiency of different categories of consumers; domestic and foreign experience in this field, as well as prospects for their development; purpose, classification, design and physical basis of the main power equipment; the main energy, environmental and economic characteristics of different types of installations.</p> <p>The application of knowledge and understanding in a manner indicative of a professional approach to the work or profession, and have competencies usually demonstrated through the formation and justification of arguments and problem solving within the field of study.</p> <p>Collect and interpret information to make judgments based on social, ethical, and scientific considerations.</p> <p>Communication skills: communicate information, ideas, problems, and solutions to both specialists and non-specialists.</p> <p>Be able to: use modern domestic and foreign information support; perform calculations taking into account social and environmental factors; use modern domestic and foreign software for selecting parameters for power supply to centralized and decentralized consumers; search, analyze and select scientific and technical information.</p>

6. Course author	Department of Electrical Equipment Operation
7. Basic literature	<ol style="list-style-type: none"> 1. Rules for the installation of electrical installations. - STD.: Dean Publishing House, 2001. - 928 P. 2. Design of industrial electrical networks. / Under the order. V. I. Krupovich et al., 2nd ed. pererab. and add. - M.: Energy, 1976. - 328 P. 3. Electrotechnical reference book: In 3 t. t. 3: book 7. The use of electrical energy. /Under total. red. Professors of the MEI : N. V. N. V. Orlov (ch. red.- 7th ed., V. pr. and add. - M.: Energoatomizdat, 1988. - 616 p. 4. Reference book on power supply and electrical equipment: in 2 t. / Under total. order. A. A. Fedorova. T. 7. Electrical equipment. - M.: Energoatomizdat, 1987. - 592 P. 5. Handbook of power supply design. / Under the order. Yu. G. Barybina et al. - M.: Energoatomizdat, 1990. - 576 p.
<p>8. Content of the discipline: Electrical and switching equipment of power plants and substations; Diagrams of electric power systems and networks, design of overhead and cable power lines; fundamentals of power supply systems for industrial enterprises and transport systems; Principles of construction of relay protection and automation of electric power systems; physical processes of electrical breakdown in various environments, principles of implementation and testing isolation of high voltage.</p>	

Basic information about the discipline:	
1. Description of the discipline	Reliability of electrical networks
2. Number of credits	five
3. Prerequisites:	Mathematical modeling in electric power industry. Information technology in the electric power industry
4. Post-requisites:	-
5. Competencies:	The purpose of mastering the discipline is to form a comprehensive understanding of the essence of the theory of reliability, the need to take into account and apply its main provisions in the design and operation of electrical networks, skills in using methods for assessing their reliability. Students should: know the basics of the theory of reliability and its applications in the electric power industry; be able to use reliability indicators when solving design and operation problems in the electric power industry; own methods of assessing the reliability of electric power objects.
6. Course author	Department of Power Supply
7. Main literature	<p>1 Design of industrial electrical networks. / Ed. IN AND. Krupovich et al., 2nd ed., Trans. and add. - M.: Energiya, 1976. -- 328 p.</p> <p>2 Knyazevsky B. A., Lipkin B. Yu. Power supply of industrial enterprises. 3rd ed. reprint. and additional-M.: Higher School, 1986, - 400 P.</p> <p>3 Epaneshnikov M. M. Electric lighting. - M.: Energiya, 1973. - 352 p.</p> <p>4 Electrotechnical reference book: In 3 t. t. 3: book 7. The use of electrical energy. /Under total. red. Professors of the MEI : N. V. N. V. Orlov (ch. red.- 7th ed., V. pr. and add. - M.: Energoatomizdat, 1988. - 616 p.</p> <p>5 Reference book on power supply and electrical equipment: in 2 t./ Under total. order. A. A. Fedorova. T. 7. Electrical equipment. - M.: Energoatomizdat, 1987. - 592 P.</p>
8. Content of the discipline	<p>Introduction.</p> <p>Reliability theory. Accounting and application of the main provisions in the design and operation of electrical networks. Methods for assessing their reliability. Fundamentals of the theory of reliability and its applications in the electric power industry; Reliability indicators in solving problems of design and operation in the electric power industry; possess methods for assessing the reliability of electric power facilities.</p>

Basic information about the discipline:	
1. Name of the discipline	Electrical complexes and systems
2. Number of credits	5
3. Prerequisites:	Mathematical modeling in the electric power industry. Information technologies in the electric power industry
4. Post-requisites:	-
5. Competencies:	<p>The purpose of studying the discipline is to form undergraduates' knowledge, skills and skills on the general laws of transformation, accumulation, transmission and use of electrical energy and electrical information, as well as to study the principles and means of managing objects that determine the functional properties of existing or created electrical complexes and industrial systems.</p> <p>To know: theoretical foundations, methods of modeling and experimental research of the processes of conversion, storage, transmission and use of electrical energy and electrical information.</p> <p>To be able to: analyze the functional properties of components of electrical complexes and systems.</p>
6. Course author	Department of Power Supply
7. Main literature	<p>1 Design of industrial electrical networks. / Under the order. V. I. Krupovich et al., 2nd ed. pererab. and add. - M.: Energy, 1976. - 328 P.</p> <p>2 Knyazevsky B. A., Lipkin B. Yu. Power supply of industrial enterprises. 3rd ed. reprint. and additional-M.: Higher School, 1986, - 400 P.</p> <p>3 Epaneshnikov M. M. Electric lighting. - M.: Energiya, 1973. - 352 p.</p> <p>4 Electrotechnical reference book: In 3 t. t. 3: book 7. The use of electrical energy. /Under total. red. Professors of the MEI : N. V. N. V. Orlov (ch. red.- 7th ed., V. pr. and add. - M.: Energoatomizdat, 1988. - 616 p.</p> <p>5 Reference book on power supply and electrical equipment: in 2 t./ Under total. order. A. A. Fedorova. T. 7. Electrical equipment. - M.: Energoatomizdat, 1987. - 592 P.</p>
8. Content of the discipline	<p>Introduction.</p> <p>General patterns of transformation, accumulation, transmission and use of electrical energy and electrical information. Study of the principles and means of managing objects that determine the functional properties of existing or created electrical complexes and industrial systems. Theoretical foundations, methods of modeling and experimental research of the processes of conversion, accumulation, transmission and use of electrical energy and electrical information.</p>

Appendix 4. Description of the disciplines of the PD cycle

Basic information about the discipline:	
1. Description of the discipline	Research practice
2. Number of credits	9
3. Prerequisites:	research work of a master's student
4. Post-requisites:	research work of a master's student, master's thesis
5. Competencies:	<p>Know and understand:</p> <ul style="list-style-type: none"> - patent and literary sources on the developed topic for the purpose of their use in the performance of the final qualification work; - rules of operation of devices and installations; - physical and mathematical models of processes and phenomena related to the object under study; - information technologies in scientific research, software products related to the professional sphere; - principles of organization of computer networks and telecommunications systems; - requirements for the design of scientific and technical documentation; - the procedure for implementing the results of scientific research and development; - methods of research and experimental work; methods of analysis and processing of experimental data; <p>Be able to:</p> <ul style="list-style-type: none"> - analyze, systematize and summarize scientific and technical information on the research topic; - analyze the reliability of the results obtained; - analyze the scientific and practical significance of the research, as well as the technical and economic efficiency of the development; - compare the results of the research of the object of development with domestic and foreign analogues; <p>Own:</p> <ul style="list-style-type: none"> - theoretical or experimental methods of research within the framework of the tasks set, including a mathematical (simulation) experiment; - skills in preparing applications for a patent or for participation in a grant. <p>Acquire practical skills:</p> <ul style="list-style-type: none"> - formulation of the goals and objectives of scientific research; selection and justification of the research methodology; work with applied scientific packages and editorial programs used in research and development; - registration of the results of scientific research (registration of the report, writing of scientific articles, abstracts of reports); - work on experimental installations, instruments and stands.

6. Course author	Department of Power Supply
7. Basic literature	<ol style="list-style-type: none"> 1. Standard rules of activity of organizations of higher and postgraduate education. Approved by the Resolution of the Government of the Republic of Kazakhstan dated May 17, 2013 No. 499. 2. State Mandatory Standard of Postgraduate Education, approved by the Resolution of the Government of the Republic of Kazakhstan dated August 23, 2012 No. 1080, effective from 1 September 2013 3. Rules of the organization of the educational process on credit technology of training. Approved by the order of the Ministry of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152. 4. The Law of the Republic of Kazakhstan on Education (with amendments and additions as of 09.01.2012) 5. SES RK 5.04.034-2011. Postgraduate education. Master's degree program. Basic provisions. 6. GOST 7.1-2003 " Bibliographic record. Bibliographic description. General requirements and rules of compilation".
<p>8. Content of the discipline. The content of research practice is determined by the topic of the master's thesis and is implemented in accordance with the individual plan within the time frame determined by the curriculum. Research work on a master's program must meet the following requirements: correspond to the main research problems on which the master's thesis is being defended; be relevant, contain scientific novelty and practical significance; be based on modern theoretical, methodological and technological achievements of science and practice in the field of synthesis of organic compounds; be based on modern methods of data processing and interpretation using computer technology; performed using modern scientific research methods; contain research (methodological, practical) sections on the main protected положениям.</p>	

Basic information about the discipline:	
1. Description of the discipline	Special issues of relay protection and automation
2. Number of credits	6
3. Prerequisites:	Power supply, Electrical networks and systems, Power stations and substations, Relay protection and automation of power supply systems
4. Post-requisites:	-
5. Competencies:	<p>To know the principles of the implementation of RZ devices, to have methods for calculating their main parameters, to know the design features of the execution, to be able to choose circuit solutions for their implementation.</p> <p>Acquire practical skills in testing and checking complete relay protection devices for power supply system elements. Master the basics of designing automation tools, be able to use methods for calculating the parameters of the operation of automation devices, make competent decisions when justifying the use of automation tools in various power supply systems.</p>
6. Course author	Uakhitova A. B.
7. Basic literature	<p>1 Dictionary of energy. Second Edition Cutler J. Cleveland Boston University, Boston, Massachusetts, United States of America ISBN: 978-0-08-096811-7. Elsevier .2015 . – 680 p.</p> <p>2 Keller, K. J. (Kimberley J.) Electrical safety code manual: a plain language guide to National electrical code, OSHA, and NFPA 70E / Kimberley Keller. Library of Congress Cataloging-in-Publication Data. Elsevier- 2010. 384 p.</p> <p>3 Electricity transmission, distribution and storage systems Edited by Ziad Melhem. Woodhead Publishing Series in Energy: Number 38. 2013. 503 p.</p> <p>4 Energy Efficiency Towards the End of Demand Growth Edited by Fereidoon P. Sioshansi Menlo Energy Economics. 2013. 651 p.</p> <p>5 M. N. Wilson, ‘ Stabilization, protection and current density: some general observations and speculations ’ , Cryogenics , vol. 31 , 449–503 (1991).</p>
8. The content of the discipline.	<p>Modern problems of RZiA. Requirements for RziA. Schemes of modern microprocessor protection and automation units used in power plants of Kazakhstan. Calculation methods and algorithms for the operation of relay protection and automation devices. Principles of implementation of relay protection. Functional scheme of digital protection and the purpose of its elements. Applied current microprocessor protection. Features of differential protection of the power transformer. Selection of directional high-frequency microprocessor setpoints protection lines of the SHE2607 031 type. Automation of electric power systems.</p>

Basic information about the discipline:	
1. Description of the discipline	Theory and practice of technical experiment in the electric power industry
2. Number of credits	6
3. Prerequisites:	Power supply, Electrical networks and systems, Electric power stations and substations
4. Post-requisites:	Special issues of relay protection and automation
5. Competencies:	<p>know the basics of modeling, the basics of the theory of functions of a complex variable, topological methods for calculating electrical networks, methods for solving optimization problems, methods of statistical processing of experimental results, methods for analyzing the stability of systems;</p> <p>be able to - independently choose calculation methods, choose the necessary software, solve problems on a computer, analyze the results obtained and do conclusions based on the results of calculations;</p> <p>navigate the flow of scientific and technical information on the theory of electrical calculations.</p> <p>to acquire practical skills in the development of mathematical models, the choice of software and the analysis of the results obtained.</p>
6. Course author	Department of Power Supply
7. Main literature	<ol style="list-style-type: none"> 1. Rules for the installation of electrical installations. - STD.: Dean Publishing House, 2001. - 928 P. 2. Design of industrial electrical networks. / Under the order. V. I. Krupovich et al., 2nd ed. pererab. and add. - M.: Energy, 1976. - 328 P. 3. Reference book for the design of electric lighting./ Under the order. Mr. M. Knorringa. - L.: Energiya, 1976. - 384 p. 4. Electrotechnical reference book: In 3 t. t. 3: book 7. The use of electrical energy. /Under total. red. Professors of the MEI : N. V. N. V. Orlov (ch. red.- 7th ed., V. pr. and add. - M.: Energoatomizdat, 1988. - 616 p. 5. Reference book on power supply and electrical equipment: in 2 t. / Under total. order. A. A. Fedorova. T. 7. Electrical equipment. - M.: Energoatomizdat, 1987. - 592 P. 6. Handbook of power supply design. / Under the order. Yu. G. Barybina et al. - M.: Energoatomizdat, 1990. - 576 p.
8. The content of the discipline. Fundamentals of modeling, fundamentals of the theory of functions of a complex variable, topological methods for calculating electrical networks, methods for solving optimization problems, methods for statistical processing of experimental results, methods for analyzing the stability of systems; calculation methods, choose the necessary software, solve computer problems, analyze the results obtained and draw conclusions from the results of calculations; scientific and technical information on the theory of electrical calculations. skills in developing mathematical models, selecting software, and analyzing the results obtained.	

Basic information about the discipline:	
1. Description of the discipline	Special issues of electricity supply
2. Number of credits	6
3. Prerequisites:	Power supply, Electrical networks and systems, Power stations and substations, Relay protection and automation of power supply systems
4. Post-requisites:	Special issues of relay protection and automation
5. Competencies:	<p>Know: schemes and basic electrical and switching equipment of electric power stations and substations; schemes of electric power systems and networks, design of overhead and cable power transmission lines; fundamentals of power supply systems of industrial enterprises and transport systems; principles of construction of relay protection and automation of electric power systems; physical processes of electrical breakdown in various environments, principles of implementation and testing of high voltage insulation.</p> <p>Be able to: apply, operate and make a selection of electrical devices, machines, equipment of power stations and substations, electric power systems and networks, power supply systems.</p> <p>Possess: methods of performing calculations in relation to the use of electrical and structural materials; methods of analyzing the operating modes of electric power and electrical equipment and systems; skills of conducting standard tests of electric power and electrical equipment and systems; methods of calculating the parameters of electric power devices and electrical installations, power supply systems, relay protection and automation; methods of operation and testing of high voltage insulation</p>
6. Course author	Department of Power Supply
7. Main literature	<ol style="list-style-type: none"> 1. Rules for the installation of electrical installations. - STD.: Dean Publishing House, 2001. - 928 P. 2. Knyazevsky B. A., Lipkin B. Yu. Power supply of industrial enterprises. 3rd ed. reprint. and additional-M.: Higher School, 1986, - 400 P. 3. Reference book on power supply and electrical equipment: in 2 t. / Under total. order. A. A. Fedorova. T. 7. Electrical equipment. - M.: Energoatomizdat, 1987. - 592 P. 4. Handbook of power supply design. / Under the order. Yu. G. Barybina et al. - M.: Energoatomizdat, 1990. - 576 p. 5. Reference book on power supply of industrial enterprises: in 2 t. / under the order. A. A. Fedorov, G. V. Serbinovsky. T. 7. Industrial electric networks. - M.: Energia, 1980. - 576 P. 6. Shekhovtsov V. P. Calculation and design of the power supply scheme. Methodological proposal for the design course. - M.: FORUM: INFRA-M, 200F-214 P., ill. - (Series "Professional education").

8. Content of the discipline: Schemes and basic electrical and switching equipment of power stations and substations; schemes of electric power systems and networks; fundamentals of power supply systems of industrial enterprises and transport systems; principles of construction of relay protection and automation of electric power systems; physical processes of electric breakdown in various environments, principles of implementation and testing of high-voltage insulation. Methods of performing calculations in relation to the use of electrical and structural materials; Methods for analyzing the operating modes of electric power and electrical equipment and systems; Methods for calculating the parameters of electric power devices and electrical installations, power supply systems, relay protection and automation; methods for operating and testing high-voltage insulation

Basic information about the discipline:	
1. Description of the discipline	Scientific and technical problems of the electric power industry
2. Number of credits	4
3. Prerequisites:	Power supply, Electrical networks and systems, Electric power stations and substations
4. Post-requisites:	Special issues of relay protection and automation
5. Competencies:	<p>To know: modern analytical methods and models of complex engineering analysis; original design methods for the implementation of competitive engineering projects; modern software and hardware systems used in the energy sector and the tasks solved by these complexes; the reasons leading to the avalanche-like development of the accident, the subsystems of emergency automation, the principles of construction and selection of control actions at different stages of the accident development.</p> <p>be able to: analyze the information about the state of the EES obtained with the help of software and hardware systems; solve complex problems based on the integration of various methods and techniques in order to achieve a certain result; prepare initial data for a given real object in accordance with the formal rules of modern professional software systems for selecting the types and parameters of emergency automation tools; develop a plan for conducting computational experiments and analyze the results obtained;</p> <p>possess experience in: analysis of automatic process control systems in the EES; preparation of source data for a given object in accordance with the formal rules of modern professional software systems; use of specialized software for solving professional problems; analysis of automatic transient control systems in the EES.</p>
6. Course author	Department of Power Supply
7. Main literature	1. Rules for the installation of electrical installations. - STD.: Dean Publishing House, 2001. - 928 P.

	<p>2. Design of industrial electrical networks. / Under the peg. V. I. Krupovich et al., 2nd ed., reprint. and add. - M.: Energy, 1976. - 328 p.</p> <p>3. Electrotechnical reference: In 3 t. T. 3: kn. 7. Electrical Energy use. /Under total peg. MEI professors : N. N. Orlov (GL peg.) etc. – 7th ed. Rev. and extra – M.: Energoatomizdat, 1988. – 616 p.</p> <p>4. For Reference elektrooborudovanie power supply: in 2 volumes/Under total peg. A. A. Fedorov. Vol. 7. Electrical equipment. – M.: Energoatomizdat, 1987. – 592 p.</p> <p>5. Handbook of Electrical engineering. / Ed. YUG. Barybina et al. - M.: Energoatomizdat, 1990 .- 576 p.</p>
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8. Content of the discipline. Introduction. The purpose and content of the course. The main objectives of the course, the role in the training of a specialist. Modern analytical methods and models for complex engineering analysis. Original design methods for the implementation of competitive engineering projects. Modern software and hardware systems used in the power industry and the tasks solved by these complexes. Causes leading to the avalanche-like development of an accident, subsystems of emergency control automation, principles of design and selection of control actions at different stages the development of the accident.

Basic information about the discipline:	
1. Description of the discipline	Mathematical modeling in power engineering
2. Number of credits	5
3. Prerequisites:	Mathematical problems and computer modeling in the electric power industry, Power supply, Electrical networks and systems.
4. Post-requirements:	Stability of electric power systems
5. Competencies:	<p>As a result of studying this discipline, the student must:</p> <ul style="list-style-type: none"> - know the basics of mathematical modeling, the basics of the theory of functions of a complex variable, topological methods for calculating electrical networks, methods for solving optimization problems, methods for statistical processing of experimental results, methods for analyzing the stability of systems; - be able to independently choose the calculation methods, choose the necessary software, solve computer problems, analyze the results obtained and draw conclusions from the results of calculations;
6. Course author	Uakhitova A. B.
7. Basic literature	<p>1 Klee, H. (2007). Simulation of Dynamic Systems with MATLAB and Simulink, CRC Press, Boca Raton, FL. – This is a very detailed and comprehensive text, aimed slightly above the level of this course. For anyone with longer-term interests in dynamic systems, this text is highly recommended.</p> <p>2 AbeldinaZh., MoldumarovaZh. Radiophysics. Astana: KATU, 2015. -136p</p> <p>3 Koxegen A.E. Methodical instructions for independent works On Informatics Discipline. For students of technical specialties. Astana: KATU, 2015. -33 p.</p>

	<p>4 Daripbayeva S.Z. The course of lectures on discipline of "Informatics" Astana: KATU, 2013. -98 p.</p> <p>5 Seifullina A.O. COMPUTER SCIENCE for technical specialties. Astana: KATU, 2015. -154 p.</p> <p>Supplementary literature</p> <p>The following textbooks are suggested, rather than prescribed, for the course:</p> <p>1 Gershenfeld, N. (1999). The Nature of Mathematical Modeling, Cambridge University Press, Cambridge, UK – This book gives some good intuition concerning a wide range of mathematical models, including some covered in this course, but with few examples.</p> <p>2 Akzhigitov E.A., Takabayev K.K., Tlepiyev M.Sh., Iliasova B.A., Gripp E.A., Kadirbayeva Zh.M. Methodical instructions are worked out according to the requirements of the curriculum and the program of discipline. Astana: KATU, 2013. 43 pages.</p>
<p>8. The content of the discipline. Introduction. Fundamentals of mathematical modeling. Theory of functions of a complex variable. Topological methods for calculating electrical networks, methods for solving optimization problems. Methods of statistical processing of experimental results. Methods for analyzing the stability of systems.</p>	

Basic information about the discipline:	
1. Name of the discipline	Stability of electric power systems
2. Number of credits	6
3. Prerequisites:	Electrical networks and systems, Power supply, Transients in the electric power industry
4. Post-requirements:	Optimization of power supply systems for rural, industrial and energy enterprises
5. Competencies:	Know: equivalent circuits for the main elements of the system, engineering methods for calculating transient processes, basic calculation formulas characterizing the quantitative relationships between the parameters of transient modes. And also must be able to apply theoretical knowledge in practice, in particular: to carry out practical calculations of transients in electrical systems, to select the necessary measures and means to ensure the required quality of transients, to assess the quality of transients. apply approximate methods to analyze transient electromagnetic and electromechanical transients and stability of electric power systems.
6. Course author	Utegulov ВВ
7. Main literature	<ol style="list-style-type: none"> 1. Проектирование промышленных электрических сетей. / Под ред. В.И. Круповича и др., 2-е изд., перераб. и доп. - М.: Энергия, 1976. – 328 с. 2. Князевский Б.А., Липкин Б.Ю. Электроснабжение промышленных предприятий. 3 – е изд., перераб. и доп. – М.: Высшая школа, 1986, - 400 с. 3. Епанешников М.М. Электрическое освещение. – М.: Энергия, 1973.- 352 с. 4. Электротехнический справочник: В 3 т. Т.3: кн. 7. Использование электрической энергии. /Под общ. ред. профессоров МЭИ : Н.Н. Орлова (гл. ред.) и др. – 7 – е изд., испр. и доп. – М.: Энергоатомиздат, 1988. – 616 с. 5. Справочник по электроснабжению и электрооборудованию: в 2 т./Под общ. ред. А.А. Федорова. Т.7. Электрооборудование. – М.: Энергоатомиздат, 1987. – 592 с. 6. Справочник по проектированию электроснабжения. /Под ред. Ю.Г. Барыбина и др. – М.: Энергоатомиздат, 1990. – 576 с.
8. Content of the discipline.	Replacement schemes for the main elements of the system. Engineering methods for calculating transient processes, basic calculation formulas characterizing the quantitative relationships between the parameters of transient regimes. Calculations of transient processes in electrical systems. Measures and means to ensure the required quality of transients, to assess the quality of transients. Approximate Methods for the Analysis of Transient Electromagnetic and electromechanical transients and stability of electric power systems.

Basic information about the discipline:	
1. Description of the discipline	Optimization of power supply systems of the agro-industrial complex
2. Number of credits	6
3. Prerequisites:	Mathematical modeling in electric power industry. Information technology in the electric power industry
4. Post-requisites:	-
5. Competencies:	<p>The purpose of the discipline: the formation of the system of knowledge and practical skills necessary for solving problems in the field of optimization of power supply systems of the agro-industrial complex.</p> <p>Tasks of the discipline: to form ideas of optimization; methods of mathematical modeling of power supply systems for the purpose of their optimization; technical means of optimization of power supply systems of the agro-industrial complex.</p> <p>As a result of studying the discipline, the student must know: the classification of agricultural power supply systems, the advantages and disadvantages of existing systems, the main regulatory documents on the subject, the scientific foundations of the design, manufacturing technology, installation and operation of the latest agricultural power supply systems, the basics of mathematical analysis of power supply systems and the skills of solving optimization problems. The student should be able to: solve practical design, operational and management tasks aimed at solving issues of optimizing the power supply of the agro-industrial complex.</p>
6. Course author	Department of Power Supply
7. Basic literature	<ol style="list-style-type: none"> 1. Проектирование промышленных электрических сетей. / Под ред. В.И. Круповича и др., 2-е изд., перераб. и доп. - М.: Энергия, 1976. – 328 с. 2. Knyazevsky B.A., Lipkin B.Yu. Electricity supply of industrial enterprises. 3rd ed., Trans. and add. - М.: Higher school, 1986, - 400 p. 3. Epanshnikov M.M. Electric lighting. - М.: Energiya, 1973.- 352 p. 4. Electrical handbook: In 3 volumes. Vol. 3: book. 7. Use of electric energy. / Under total. red. MPEI professors: N.N. Orlova (chap. Ed.) And others - 7th ed., Rev. and add. - М.: Energoatomizdat, 1988. -- 616 p. 5. Electrical guide a ndelectrical equipment: in 2 tons / Under total. red. AA Fedorova. T.7. Electrical equipment. - М.: Energoatomizdat, 1987. -- 592 p. 6. Electrical Design Handbook. / Ed. SOUTH. Barybina and others - М.: Energoatomizdat, 1990. -- 576 p.

8. Content of the discipline. Methods for mathematical modeling of power supply systems for the purpose of their optimization. Technical means of optimization of power supply systems of the agro-industrial complex. Classification of power supply systems of the agro-industrial complex. Advantages and disadvantages of existing systems. The main regulatory documents on the subject, scientific fundamentals of design, manufacturing technology, installation and operation of the latest power supply systems for the agro-industrial complex Fundamentals of mathematical analysis of power supply systems and skills for solving optimization problems. The student should be able to: solve practical design, operational and management tasks aimed at solving the issues of optimizing the power supply of the agro-industrial complex.

Basic information about the discipline:	
1. Description of the discipline	Optimization of industrial power supply systems enterprises
2. Number of credits	
3. Prerequisites:	Mathematical modeling in electric power industry. Information technologies in the electric power industry
4. Post-requisites:	-
5. Competencies:	The purpose of the discipline: introduction to methods of optimization of power supply systems of industrial enterprises. Students should know: the issues of automation of individual design processes for reconstruction of objects; development and implementation of computer-aided design (CAD) systems for construction and reconstruction of objects, including automated production and processing of project documentation. Be able to: develop work schedules, make calculations on the formation of the numerical and qualification composition of teams and determine their production capabilities under various working conditions; organizational and technological modeling of the construction and reconstruction of objects; calculation of the need for material and technical resources, etc.
6. Course author	Department of Power Supply
7. Basic literature	1. Проектирование промышленных электрических сетей. / Под ред. В.И. Круповича и др., 2-е изд., перераб. и доп. - М.: Энергия, 1976. - 328 с. 2. Князевский Б.А., Липкин Б.Ю. Электроснабжение промышленных предприятий. 3-е изд., перераб. и доп. - М.: Высшая школа, 1986, - 400 с. 3. Епанешников М.М. Электрическое освещение. - М.: Энергия, 1973. - 352 с. 4. Электротехнический справочник: В 3 т. Т.3: кн. 7. Использование электрической энергии. /Под общ. ред. профессоров МЭИ: Н.Н. Орлова (гл. ред.) и др. - 7-е изд., испр. и доп. - М.: Энергоатомиздат, 1988. - 616 с. 5. Справочник по электроснабжению и электрооборудованию: в 2 т./Под общ. ред. А.А. Федорова. Т.7. Электрооборудование. - М.: Энергоатомиздат, 1987. - 592 с.
8. The content of the discipline.	Introduction to the discipline. Methods of optimization of power supply systems of industrial enterprises. Automation of individual design processes for reconstruction of objects. Development and implementation of computer-aided design (CAD) systems for construction and reconstruction of facilities, including automated production and processing of project documentation. Work schedules. Calculations on the formation of the numerical and qualification composition of teams and the determination of their production capabilities under various working conditions; organizational and technological modeling of construction and reconstruction of objects; calculation of the need for material and technical resources, etc.